IV. REMARKS

Claims 1-40 were originally filed in United States Serial No. 09/560,469, which was filed on April 28, 2000. Claims 41-46 were added via Preliminary Amendment on June 5, 2002. In response to a restriction requirement by the Office, Applicants elected claims 1-27 and 41-44. Claims 28-40, 45 and 46 have been withdrawn from consideration. Applicants respectfully request reconsideration and allowance of claims 1-27 and 41-44, in view of the amendments and remarks presented herein.

Objection to Specification

The recitation of "flange 16 area" at page 19, line 19 of the specification has be objected to. Applicants have amended "flange 16 area" to read "flange area 16". Applicants respectfully submit that this amendment overcomes the objection and request that the objection be withdrawn.

35 U.S.C §112

Claims 8, 9 and 19-25 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. It is specifically alleged that claims 8, 9 and 19-25 include method limitations which render the claims vague and indefinite.

Independent claims 1 and 12 are presented in product-by-process format. Claims 8 and 9 depend from independent claim 1, claims 19-24 depend from independent claim 12, and claim 25 depends from claim 22, which in turn, depends from claim 12. Claims 8, 19, 20 and 25 do not recite method limitations. Rather,

these claims recite structural limitations to the minimum residual holding force of the support element.

Claims 9 and 21-24 recite method limitations. Claims 9 and 21 recite method limitations with respect to the formation of the support element of the exhaust gas treatment device. Claims 22-24 recite method limitations with respect to the heat treatment of the fibers of the support mat. Claims 22-24 have been amended to more clearly recite these limitations. Claims 9 and 21-24 are clear as originally filed, as independent claims 1 and 12 are presented in product-by-process format. As product-by-process claims define a product by the process in which it is obtained, dependent claims to process limitations are proper. Therefore, it is respectfully submitted that claims 8, 9 and 19-25 are clear and particularly point out and distinctly claim the subject matter which Applicants regard as their invention. Applicants respectfully request that the rejection under 35 U.S.C §112 be withdrawn.

35 U.S.C §103

Claims 1-27 and 41-44 are rejected under 35 U.S.C. §103 over USPN 5,580,532 (Robinson), in view of JP 07-286,514 and GB 1,481,133. It is specifically alleged that Robinson discloses a device comprising a housing and a fragile structure mounted in the housing with a non-expanding support element of ceramic fibers containing alumina and silica disposed between the housing and fragile structure.

It is also alleged that JP 07-286,514 discloses a ceramic fiber mat disposed between a catalyst and a housing in which the ceramic fibers have been heat treated at a temperature of 1300°C for 4 hours to produce a crystallinity of 0-10% crystallinity. However, the Office Action concedes that the crystallite size of the heat treated fibers is not disclosed in JP 07-286,514. It is also alleged that GB 1,481,133 discloses to heat treat fibers at 950°C to 1050°C from 10 minutes to 1 hour to produce fibers having a

crystallite size of less than 200Å. Therefore, it is alleged that it would have been obvious to one having ordinary skill in the art to heat treat the ceramic fiber of Robinson to form fibers having a percent crystallinity as allegedly disclosed by JP 07-286,514 and the crystallite size as allegedly disclosed by GB 1,481,133.

Applicants respectfully traverse this rejection. None of the references, alone or in combination, provide any teaching or suggestion to heat treat melt-formed ceramic oxide fibers according to the presently claimed method. For example, the Office Action concedes that the Robinson reference "is silent" with respect to heat treating the fibers of the support element. Applicants agree that the Robinson reference "is silent" with respect to heat treating the fibers of the support element, and does not provide any teaching or suggestion to heat treat the ceramic fibers of the mounting mat. The Great Britain patent is strictly limited to heat treating fibers at 950°C to 1050°C from 10 minutes to 1 hour and, therefore, expressly teaches away from the presently claimed time-temperature regimens treat fibers. The Japanese reference also does not teach or suggest to heat treat ceramic fibers by either of the presently claimed time-temperature regimens.

The presently claimed support element comprises an integral, substantially non-expanding ply of melt-formed ceramic fibers containing alumina and silica. In one embodiment, the fibers of the support element are prepared by heat treating the fibers under a time-temperature regimen of heat treating at 990°C to at least 1050°C for greater than 1 hour such that the fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å. In another embodiment, the fibers are heat treated under a time-temperature regimen of heat treating at a temperature of greater than 1050°C for an effective amount of time such that the fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å.

JP 07-286,514 does not teach, suggest or provide motivation to heat-treat melt formed alumino-silicate fibers under a time-temperature regimen of (i) heat treating said fibers at a temperature of at least 990°C to less than about 1100°C for greater than one hour, such that the fibers have at least about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and have a crystallite size of from about 50Å to about 500Å, or (ii) heat treating said fibers at a temperature of at least about 1100°C for a time effective to develop said crystallinity and said crystallite size. Nowhere in JP 07-286,514, does it teach to heat treat the ceramic fibers to produce a controlled crystallinity and crystallite size prior to formation of the blanket. The only time-temperature regimen disclosed in JP 07-286,514 is contained in paragraph [0006] of that document. Here, the crystallinity of the inventive fibers are compared to the crystallinity of a completely crystallize mullite fiber, which was prepared by calcining at 1300°C for 4 hours. However, this calcined fiber is a reference fiber and does not form part of the invention of JP 07-286,514. No other time-temperature regimens are disclosed in JP 07-286,514 for heat treating the fibers that are to be incorporated into the support element for the fragile structure. In any event, JP 07-286,514 does not disclose or suggest the use of melt-formed ceramic oxide fibers.

GB 1,481,133 discloses only one time/temperature regimen for heat treating ceramic fibers, namely heat treating fibers in a temperature range of 950°C to 1050°C for 10 minutes to 1 hour. GB 1,481,133 clearly and unequivocally teaches that "...the use of an excessive temperature above the devitrification temperature, or use of a sufficient devitrification temperature held for an excessive period of time, will tend to produce a coarse-grained structure with poor handling properties." (page 2, lines 97-101). Furthermore, GB 1,481,133 specifically teaches to quickly terminate the heating subsequent to formation of the crystalline product, but prior to the onset of excessive grain growth. (page 1, lines 83-92). GB 1,481,133 teaches that coarse-grained fibers, formed by excessive heat treatment, will exhibit poor handling properties.

In contrast to the Great Britain reference, the present invention discloses two separate and distinct time/temperature regimens for heat treating ceramic fibers, namely 990°C to at least 1050°C for greater than 1 hour (claim 1), or heat treating at a temperature of greater than 1050°C for an effective amount of time such that the fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å (claim 12). The time-temperature regimen of claim 1 is outside GB 1,381,133, as GB 1.481,133 is limited to a time temperature regimen of 950°C to 1050°C for 10 minutes to 1 hour.

Moreover, Applicants have surprisingly discovered that heat treating ceramic fibers at the devitrification temperature of the fiber for periods of time in excess of the time taught by the Great Britain patent, preferably greater than 1 hour, or heating the fibers at a temperature well above the devitrification temperature of the fibers results in the formation of a coarse-grained fiber structure that unexpectedly has excellent mechanical and handling properties, and that is capable of exerting a minimum holding pressure of 4 psi. This finding is in direct contravention of the teachings and disclosure of the Great Britain patent.

To illustrate the unexpected results obtained, Applicants wish to draw the Examiner's attention to the comparative testing performed by Applicants, which has been included in the present disclosure at pages 18-21 (including Table I) of the specification. Briefly, Applicants prepared five (5) fiber mats according to one of the two the time/temperature regimens disclosed in the present invention (Example Nos. 1-5). The fiber mats were evaluated for minimum holding pressure and handling properties, and were compared to fibers mats composed of fibers that were heat treated according to the methods disclosed by Great Britain '133 (Comparative Examples C and D).

As Table I shows, the fiber of Example No. 1 is a fiber comprising 98% melt spun large diameter aluminosilicate fiber and 2% E-glass. The fiber of Example No. 1 was heat treated under a time/temperature regimen of 1300°C for 2 hours. The fiber of Example No. 2 is a fiber comprising 98% melt spun small diameter aluminosilicate fiber and 2% E-glass. The fiber of Example No. 2 was heat treated under a time/temperature regimen of 1100°C for 2 hours. The fiber of Example No. 3 is a 98% melt spun large diameter aluminosilicate fiber and 2% E-glass fiber, and was heat treated under a time/temperature regimen of 1100°C for 2 hours. The fiber of Example No. 4 is a 100% melt spun large diameter aluminosilicate fiber that was heat treated at 1100°C for 2 hours. Finally, Example No. 5 is a 100% melt spun large diameter aluminosilicate fiber that was heat treated at 1200°C for 2 hours.

The fiber of Comparative Example C is a 100% melt blown small diameter aluminosilicate fiber that was heat treated according to the time/temperature regimen of the Great Britain reference, namely 1050°C for 30 minutes. The fiber of Comparative Example D is a 100% Kaolin-based fiber that was heat treated according to the time/temperature regimen of the Great Britain reference, namely 1050°C for 1 hour.

The fibers of Example Nos. 1-5 exhibit a minimum holding pressure of at least 13.13 psi after 200 cycles of compression testing at 900°C, and a minimum holding pressure of at least 6.81 after 1000 cycles of compression testing at 200°C. In contrast, the fibers of Comparative Examples C and D prepared according to Great Britain '133 exhibit a minimum holding pressure of about 0.86 after 200 cycles of compression testing at 900°C.

The results of the comparative testing clearly indicate that the fiber mats comprising ceramic fibers that were previously heat treated according to one of the two time/temperature regimens disclosed by the present invention exhibit increased minimum

holding pressure as compared to fiber mats comprising ceramic fibers heat treated according to the time/temperature regimen of the Great Britain patent.

It should be noted that it was surprising and unexpected, in view of the teachings of the Great Britain patent, that heat treating ceramic fibers for excessive periods of time at the devitrification temperature or heat treating the ceramic fibers at a temperature substantially above the temperature taught by the Great Britain patent would result in a fiber having excellent mechanical and handling properties and having the ability to exert a minimum holding pressure of at least 4 psi. Applicants assert that heat treating ceramic fibers at time/temperature regimens outside of that disclosed by Great Britain '133 produces fibers that exhibit good mechanical properties and increased holding pressures and, therefore, the time/temperature ranges disclosed in the present invention are not obvious in view of the prior art.

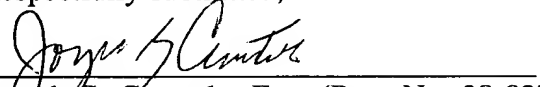
Applicants also submit that there is no teaching or disclosure that the fibers of Great Britain Patent 1,481,133 exert any minimum holding pressure, or are suitable for use as mounting mats in catalytic converters. Furthermore, there is no teaching or suggestion that heat treating ceramic outside the time/temperature regimen disclosed by the Great Britain reference would produce a ceramic fiber having good mechanical properties and the ability to exert a holding pressure of at least 4 psi. Applicants assert that the Great Britain patent clearly teaches away from heating fibers at any time or temperature outside of the range disclosed. Furthermore, there is no teaching in the Great Britain reference that the fibers disclosed therein would be useful in mounting mats of catalytic converters.

As none of the references, alone or in combination, provide any teaching or suggestion to heat treat melt-formed ceramic oxide fibers according to the presently claimed method, Applicants respectfully submit that claims 1-27 and 41-44 are non-obvious and patentable over the prior art of record.

In view of the foregoing amendments and remarks, Applicants respectfully request reconsideration of the present application, withdrawal of the 35 U.S.C. §§112 and 103 rejections, and allowance of claims 1-27 and 41-44.

Should the Examiner have any questions, Applicants' undersigned attorney would welcome a telephone call.

Respectfully submitted,



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